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FIG GROWING *in the* SOUTH ATLANTIC *and* GULF STATES

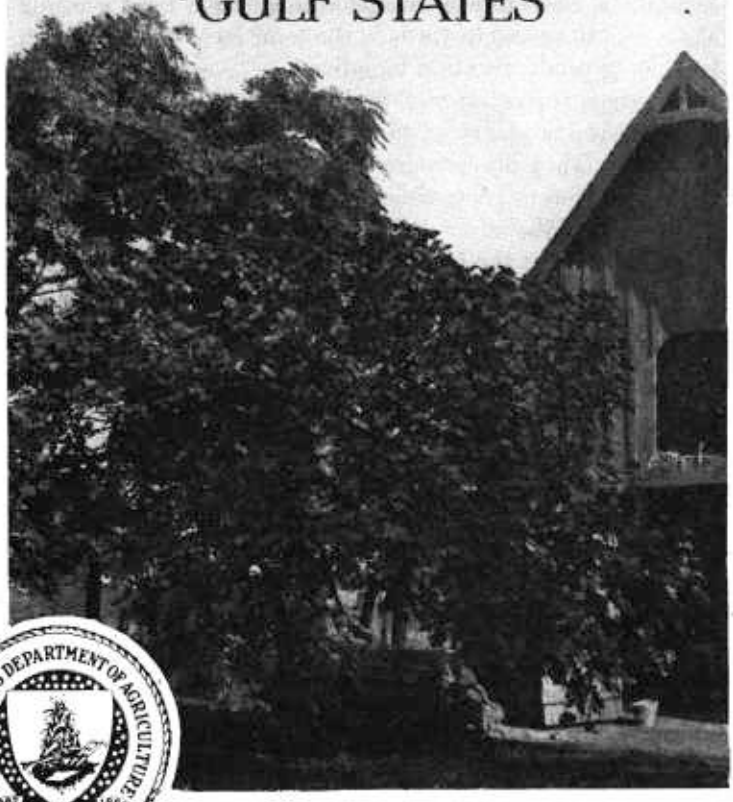

FIG GROWING in the South Atlantic and Gulf States is peculiarly a home enterprise, supplying the family with a fruit that is used in many ways, though in the Gulf-coast section of Texas many orchards of considerable size have been developed.

Orchards planted east of the Mississippi River, with few exceptions, have proved disappointing, while trees growing about buildings and in yards in the same localities have been habitually productive and long-lived.

Fig trees thrive on well-drained, reasonably fertile soil which contains plenty of humus and is well supplied with moisture. They also require care in tillage, to avoid injury to the fine fibrous roots which are characteristic of fig trees. East of the Mississippi River these conditions usually are better met about the homes than in orchards.

This bulletin tells about growing figs in the South Atlantic and Gulf States and protecting the figs from diseases and insects; it discusses the varieties commonly grown, and suggests methods of making the fruit into desirable products for the table.

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FIG GROWING IN THE SOUTH ATLANTIC AND GULF STATES

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CONTENTS

EXTENT OF FIG GROWING

FIG TREES are widely distributed in the South Atlantic and Gulf States. They occur in considerable numbers in the southeastern part of Virginia, especially in the sections adjacent to the lower part of the Chesapeake Bay, and in eastern North Carolina. They are rather generally distributed in varying numbers throughout South Carolina, Georgia, Alabama, Mississippi, and Louisiana. In Florida they are mainly confined to the northern and northwestern counties. In six counties in the northern Gulf-coast section of Texas, there were reported by the 1930 census to be nearly 1,000,000 trees of bearing age and 156,000 not of bearing age, excluding many trees more widely distributed in eastern Texas. In Maryland, Tennessee, Arkansas, and Oklahoma, there were reported in 1930 to be from 900 to about 4,000 bearing fig trees and smaller numbers not of bearing age in each State. The 1930 census reports more than three times as many bearing fig trees in the Texas Gulf-coast section as there were in all of the other States enumerated combined.

There were formerly a few fig orchards of some commercial importance in the vicinity of Norfolk, Va., but they have declined consider-

[1] Certain sections of this bulletin were contributed by other members of the Department's staff, as indicated in a footnote in each instance.

ably in recent years. The million trees in the Gulf-coast section of Texas consist mainly of commercial plantings (fig. 1).

In the other States that have been mentioned, most of the individual plantings consist of a few trees or bushes about the buildings or in the yards, where generally they appear to flourish. The aggregate number of trees is considerable because there are so many of these small dooryard or garden plantings. Some of these plantings produce surplus fruit which is marketed locally, or in some communities is gathered from day to day and taken to small establishments for canning or preserving by other means. Trees typically located about buildings are shown in figure 2 and on the title page.

In many places in the States between Virginia and the Texas Gulf-coast section orchards of considerable commercial size have been planted from time to time. For one reason or another, however, these orchards have generally failed before they reached the

FIGURE 1.—A view in a Magnolia fig orchard in the Gulf-coast section of Texas in late summer. The trees have been planted 8 or 9 years, but were killed back to the ground by a freeze which followed a long period of unseasonably warm weather in the winter.

age of profitable production. The fig is grown throughout an extensive region and fig trees occur about the buildings more generally, doubtless, than any other kind of fruit tree, but fig production has not been developed into an industry of commercial importance except in a very few localities or sections (figs. 3, 4, and 5). The northern Gulf-coast section of Texas, as already indicated, is one of those. Some of the reasons for this situation will be touched on later.

DISTRIBUTION LIMITED BY CLIMATIC CONDITIONS

Undoubtedly, the climatic conditions, especially temperature and moisture, are the chief limiting factors in determining the geographical range of adaptability of any fruit. In the South Atlantic and Gulf States, the temperature is probably the most potent factor with respect to fig growing. Throughout most of the area, the average length of the growing season—that is, the period between

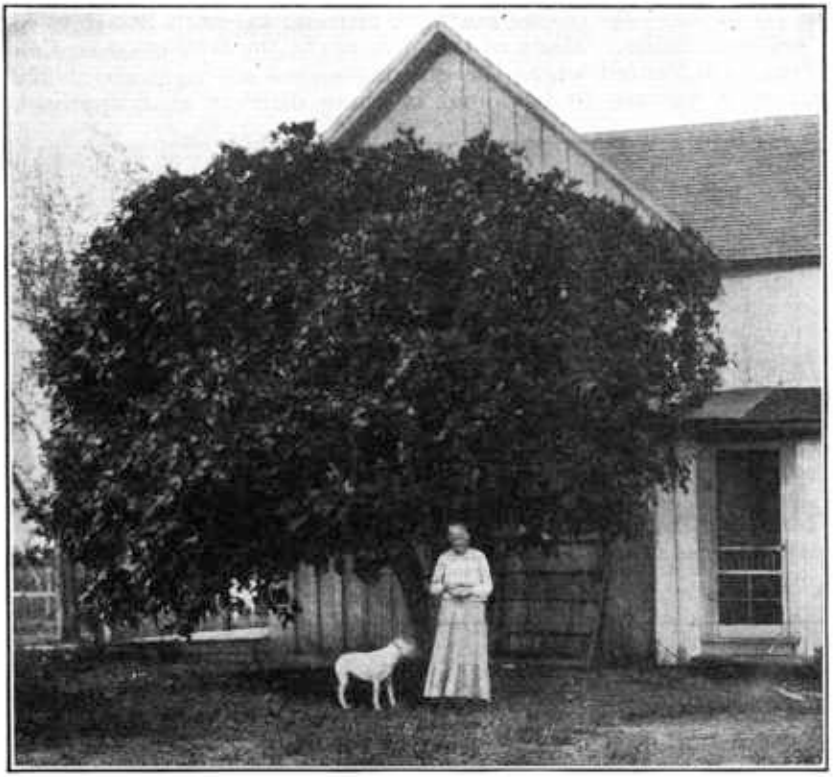

FIGURE 2.—A Celeste fig tree about 18 years old in southern Louisiana in midsummer. Most of the fig trees in Louisiana and eastward are growing near buildings, in dooryards, or in gardens, and the fruit is used chiefly for the family's own needs. Girls' canning clubs preserve large quantities of figs from such trees.

FIGURE 3.—A small block of 5-year-old fig trees in southern Georgia. These trees are probably growing in better soil and have received cultural treatment better suited to the requirements of the fig than those in most plantings.

the last killing spring frost and the first killing fall frost—varies from about 200 days in the northern districts to about 260 days in the southern limits. Many of the orchards in the Gulf-coast section of Texas are located where the growing season averages about 270 days; very few are to be found in those districts that approach

FIGURE 4.—A southern Alabama fig orchard in July of its fourth season's growth. It originally consisted of 13,400 trees and occupied 80 acres.

FIGURE 5.—View (taken in September) in a Magnolia fig orchard located not far from Houston, Tex. The trees had previously been injured by adverse temperature and had not fully recovered. The sprouts had not been removed from about the base of the stems, which is usually done sometime in the course of the season (fig. 1). A metal pail or bucket (as shown in the picture) is commonly used as a picking receptacle.

subtropical conditions, where in some seasons no frost occurs. Throughout the most of this fig-growing area the precipitation averages from about 40 to 55 or 60 inches annually, varying considerably in different sections.

For the months of December, January, and February, which are probably the critical ones so far as winter injury is concerned, the mean daily temperature for 10 or 12 widely distributed stations averages about 39° F., with a range of from 32° to 51° F. between different points. The average of the absolute minimum is about 8.5°, the range being from —5° to 20° F. Temperatures below 0° F. occur only very rarely in any part of this area.

While the foregoing statements regarding temperature are indicative of general conditions, it must be noted that mean or average temperatures for any period have but small significance in determining the limits of vegetation in the region. It is, rather, the extremes and their duration that are the determining temperature factors.

Winter injury to fig trees in this area is not unusual. Perhaps the districts most nearly free from such injury are those in southeastern Virginia and the Gulf-coast section of Texas. In the former the mean minimum temperature for December, January, and February is 36°, 34°, and 34° F., respectively, and the mean maximum temperature is 51°, 49°, and 50°; the absolute minimum temperatures by months are 5°, 5°, and 2°. In the Texas section both mean minimum and mean maximum temperatures are considerably higher than in the Norfolk, Va., district.

So far as information is available, the absolute minimum reached throughout this entire area is rarely low enough to cause injury to well-matured fig trees in a perfectly dormant condition. But not infrequently in many sections there are warm periods in the winter of sufficient duration to cause the buds to start. In that condition they may be susceptible to injury by subsequent low temperatures that are entirely seasonable and would cause no injury to completely dormant trees. Hence, it appears to be in reality the unseasonably warm periods rather than intrinsically low temperatures that are dangerous.

The last half of the January following the date of the picture shown in figure 4 was unseasonably warm. The buds began to open, the leaves reaching a size of one-fourth to one-half inch across the blade. On February 3 the temperature dropped to 22° F. The trees in nearly half of the orchard were killed back practically to the ground; the injury for some reason was not so severe in the other half of the orchard. However, subsequent injury from adverse temperatures was so great that the trees were all dug up after their fifth season.

The extent that fig trees have proved less subject to winter injury in the vicinity of Norfolk, Va., than in most other sections east of Texas is believed to be due to the comparative absence of unseasonably warm periods of sufficient duration to cause the buds to start. This is due largely to the proximity of the waters of the Chesapeake Bay and the Atlantic Ocean, which undoubtedly have an equalizing effect on the temperature of immediately adjacent land areas and moderate the wide fluctuations that would otherwise occur. This explanation can hardly apply to the comparative absence of winter injury to fig trees in the Gulf-coast section of Texas, since, as noted above, maximum temperatures there seem sufficiently high to stimulate tree activity at almost any time. Probably the absence there of freezing weather at critical periods and the greater uniformity of temperature

with less marked variations contribute to the comparative freedom from winter injury.

Whether the waters of the Gulf of Mexico have an ameliorating or equalizing effect on the climate of this section which is favorable to fig growing is a question. Such an influence of large bodies of water on the climatic conditions of adjacent land areas is well recognized in some sections. In this section, also, the orchards consist very largely of the Magnolia variety, rarely planted east of the Mississippi River. The growth and fruiting habits of this fig tree probably permit of the killing back of the branches without seriously restricting the crop the following season to a greater extent than do those of most other varieties.

When injury from adverse temperatures does occur in this section, it usually follows exceptionally warm periods of considerable duration, or it results from late spring frosts or freezes that occur after the trees have normally started into growth. There are probably also other contributing factors that affect the condition of the trees and their susceptibility to injury from adverse weather conditions. Very heavy pruning, such as is practiced by some growers, is said to stimulate early budding of the trees, and this may result in cold injury. On the other hand, good cultivation and other practices, including the protection of the foliage against rust and other diseases by spraying, which maintain the trees in a healthy, vigorous condition, render them more resistant to adverse conditions.

In general, it is commonly believed that after a fig tree has reached the age of 3 or 4 years it will withstand lower temperatures without serious injury than during its earlier years.

SUITABLE SOILS

Fig trees will grow on a wide range of soil types, provided they are well drained, well supplied with moisture, and reasonably fertile. A fairly high degree of fertility is probably more essential than is commonly supposed.

The importance of soil conditions in growing figs is not fully appreciated. Many of the light sandy soils in which figs have been widely planted are low in fertility and often lacking in humus. They also suffer badly at times from drought. Many of the fig orchards planted in the southeastern part of the United States in the past which have failed have been on such soils.

On silt and alluvial soils, which, while well drained, are usually well supplied with moisture and are widely recognized for their fertility, fig trees are characterized by strong growth and dark, luxuriant foliage.

Fig trees generally grow well also on the heavier types of soil in the Gulf-coast section of Texas, though these soils are not always as well drained as some of the lighter soils in other parts of the fig belt.

The several types of soil of importance in the present connection and the influence of their characteristics upon fig growing may be grouped as follows:

(1) Light sandy soils, which commonly lack (*a*) fertility, (*b*) humus, and (*c*) moisture. Because of the lack of humus and moisture, the temperature in the surface soil often becomes extremely high in summer, especially where the soil is not covered with vegetation. Moreover, these conditions are extremely favorable for the

nema or nematode, a root parasite to be considered later. On such soils as these many of the failures of figs have occurred.

(2) Light sandy soils, such as those described in the preceding paragraph but located differently, as, for instance, in gardens where the soils have been made more fertile and have received more humus, and, chiefly because of the humus, are less subject to drought and probably do not become so hot as where these conditions do not obtain; also in locations near buildings where, because of the shade afforded and the increased humus and moisture supply in comparison with an open field, as well as for other reasons, the adverse conditions mentioned in the previous paragraph are much less extreme. A large proportion of the fig trees east of the Mississippi River are growing under such soil conditions as these.

(3) Silt and alluvial soils, which commonly occur along the larger streams. In contrast to those specified in paragraph 1, these soils are fairly fertile, well supplied with humus, not seriously subject to drought (partly because of being well supplied with humus), and doubtless subject to less intense temperature of the surface soil (because of being well supplied with humus and not seriously subject to drought). Fig trees on such soils usually develop dark, luxuriant foliage and make a good, strong growth.

(4) The more clayey soil types that occur in the Gulf-coast section of Texas. These soils, though not so well drained as a rule as the other types mentioned, possess some good qualities. In comparison with those specified in paragraph 1 they are fairly fertile, supplied with a higher content of humus, less seriously subject to drought, and less favorable to the nematode. Moreover, they are known to contain considerable lime, which is very largely lacking in most of the other types under consideration. Growers occasionally remark that fig trees particularly require lime in order to thrive. The importance of lime may be greater than is commonly realized. Most of the fig orchards in Texas are on these heavier soils, while in Louisiana they are as a rule either on comparatively heavy soils, or on silt and alluvial types.

PROPAGATION

Fig trees usually are propagated from cuttings. This method is so simple and is used so generally that no special consideration of other methods is needed here.

Cuttings are made during the dormant period from well-matured wood of the preceding season's growth. The long, slender, sappy shoots that sometimes sprout from the ground should not be used. The center of the branches used for cuttings is occupied by a large pith, except at the nodes, or points where the leaf stems are attached. Here the branch is solid throughout, and it is from this area only that roots put forth.

Therefore, in making cuttings the lower ends should be severed just below the nodes. Otherwise, any portion of a branch below a node which contains the pith is in effect deadwood and likely to cause trouble sooner or later from decay. For a similar reason the top of a cutting should be severed just above a bud. If a stub remains above the topmost bud it dies and is likely to decay. While these details as to where the cuts are made in severing a cutting

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from a branch are not always carefully observed, the best practice requires it.

Ordinarily cuttings are made about 8 or 10 inches long, but the length is governed largely by the vigor of growth and the distance between the nodes or buds, the latter being to some extent a matter of variety. The cuttings may be made in the fall or early winter or in the spring. If made in the fall, they are packed in damp moss, moist sand, or otherwise kept moist and cool so that they will remain dormant until the weather is suitable for planting in late winter or early spring. If made upon the approach of spring, they are planted in nursery rows at once. The former practice, which provides for the callusing of the cuttings, is preferred by some propagators, as they believe it gives rather better results.

FIGURE 6.—Fig trees in a Florida nursery as they appeared in the middle of September. They were placed in the nursery as cuttings the preceding spring and will be ready for permanent planting in the late autumn. The variety in the foreground is Brown Turkey.

In planting the cuttings in the nursery, furrows 6 or 8 inches in depth are opened, in which the cuttings are placed in a vertical position 8 or 10 inches apart in the row. The depth at which the cuttings are planted should be governed by their length. One bud should remain just above or even with the surface of the ground. The soil must be packed very firmly about the cuttings.

Under favorable conditions, the cuttings in one season will root and develop into trees suitable for permanent planting. Figure 6 shows a block of fig trees in a Florida nursery in September which were lined out as cuttings the preceding spring.

Fig trees sometimes are propagated by layers, and they may be grafted or budded.

SITES FOR FIG TREES

The "site" is the exact piece of land on which the trees are planted. Aside from the soil, which has been discussed, little need be said, since in so large a part of the fig belt the plantings occur near where buildings are located or where the ground is very level, giving little opportunity for choice as to site. However, in some limited sections where there is considerable variation in topography it has been observed that trees planted on northern slopes start into growth later in the spring than those on southern slopes and therefore may escape injury from freezing temperatures when those on southern slopes suffer severely.

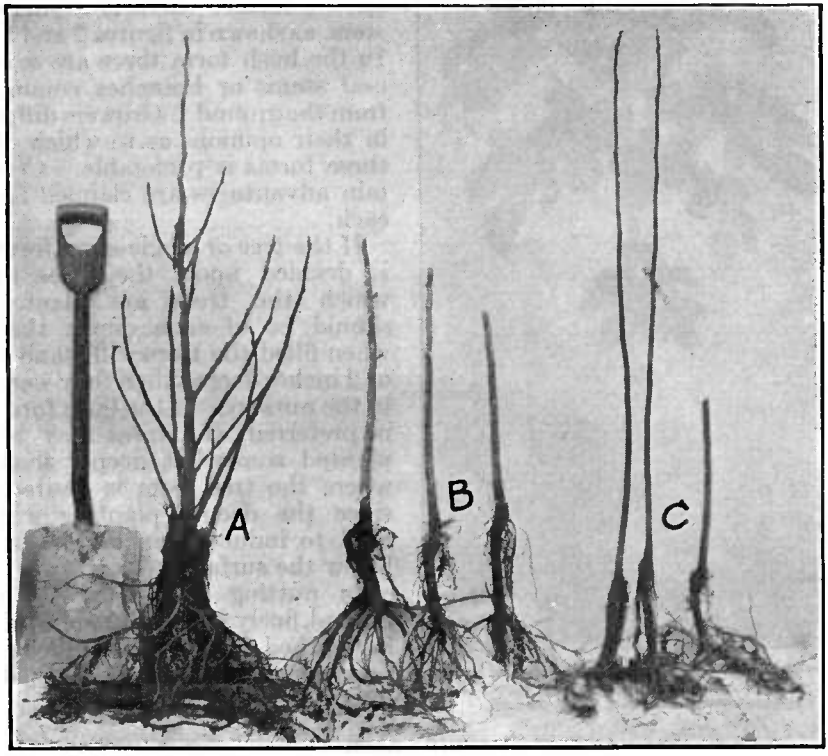

FIGURE 7.—Fig trees that have made one season's growth in the nursery from cuttings. They are of the right age to plant: *A*, A heavily branched tree of the Celeste variety; *B*, Magnolia trees cut back for planting; *C*, Brunswick trees, showing 2 unpruned and 1 cut back for planting.

PLANTING THE TREES

Typical fig trees that have made one season's growth in the nursery from cuttings and are in good condition for permanent planting are shown in figure 7. Where the cuttings are planted in the nursery with only one bud above the ground, the growth the first season is usually a straight unbranched stem, as is shown by trees *B* and *C*, but in some cases a tree may branch in the manner shown by tree *A*.

Very strong root systems with many small fibrous roots, such as have been developed by the trees shown in figure 7, are typical of

well-rooted trees from the nursery. For the proper planting of such trees the soil should be deeply plowed and very thoroughly prepared. Recently broken sod land cannot ordinarily be put into as good condition for tree planting as that which has been turned long enough for the sod to have become well rotted.

The holes in which the trees are set should be broad enough to receive the roots without bending from their normal positions, though the long straggling roots may be cut off to make them correspond in length with the main portion of the root system.

FIGURE 8.—Fig tree in the middle of its first season's growth. It was headed about 3 feet high and was a straight, unbranched stalk when planted.

BUSHES OR TREES

At the time of planting, the grower should decide whether he prefers to have fig trees or bushes. In the former there is a single stem, as shown in figures 2 and 8. In the bush form there are several stems or branches coming from the ground. Growers differ in their opinions as to which of these forms is preferable. Certain advantages are claimed for each.

If the tree or single-stem form is decided upon, the holes in which the trees are planted should be of such depth that when filled the trees will stand 1 or 2 inches deeper than they were in the nursery. If the bush form is preferred, the trees may be planted somewhat deeper than where the tree form is desired, since the deeper planting will tend to induce branching from below the surface.

In putting a tree into the ground, finely pulverized soil must be worked in among the roots very completely and be packed firmly as the holes are filled.

HEADING-BACK

At the time of planting, the trees should be headed back, as shown by the tree at *B* and one of those at *C* in figure 7. The exact height at which they are headed varies with the ideals of different growers, but from 12 inches to 3 feet above the surface is usually satisfactory. A tree headed about 3 feet high when planted is shown in figure 8 as it appeared in July of its first season's growth after being permanently planted. A heavily branched tree, like that shown in figure 7, *A*, should be headed back considerably. If the grower wishes a tree form, the main stem should be cut back to the desired height, the lower branches removed, and those branches that are to remain

should be cut back enough to make them of uniform length. If a bush form is desired, the lower limbs need not be removed. Again, if the bush form is selected, the trees may be headed somewhat lower than is necessary for the tree form. Very low heading will tend to induce branching from below the ground and the development of sprouts from the roots. In fact, very many figs throughout the region covered by this bulletin that were planted as trees have become bushes as a result of being frozen back to the ground, the numerous sprouts that came up later being left to develop.

PLANT DURING DORMANT SEASON

The season for planting figs has a rather wide range. The winter climate throughout most of the fig belt is comparatively mild, and the soil may be worked much of the time during the entire winter. Fig trees, therefore, may be planted either in the late autumn, after they become perfectly dormant, or before growth starts in the spring. Many are planted during February and March; that is, after the colder winter weather is past.

DISTANCES FOR PLANTING

The distance apart at which fig trees are planted varies greatly The more common distances are 10 by 10, 16 by 16, 15 by 20, and 20 by 20 feet. In the Texas orchards trees are rarely planted closer than 16 feet or farther apart than 20 feet each way. If planted where the soil is poor or in a section where the winter temperatures may be expected to kill back the limbs considerably every few years, thus preventing the trees or bushes from reaching a large size, the shorter distances may be satisfactory; but where the soil and climate are favorable to a large growth, the greater distances will not provide more space than is needed. Some growers advocate planting 22 or even 25 feet apart each way where a strong and uninterrupted growth is expected.

In one case in southern Alabama, on sandy soil made fairly fertile with humus and fertilizers, it was found that after two seasons' growth the roots of Celeste trees planted 16 feet apart each way overlapped considerably in the center of the space between the trees. This suggests that the roots may crowd seriously before the tops do. Moreover, the manner in which the trees are to be pruned should be considered in spacing them. If the tree or single-stem form of growth is to be developed, more space relatively will be needed than where the bush form is strictly followed. The form adopted may be determined by the variety or climate or, to some extent, by personal preference.

MAINTAINING THE FERTILITY OF THE SOIL

TILLAGE

The following requirements for successful fig growing are very closely related to tillage practices:

Fig trees do not compete successfully with weeds and other kinds of vegetation. Where this appears not to be true, soil conditions probably are particularly favorable for the growth of the fig.

While the fig develops large roots it also has a remarkably extensive system of fine fibrous roots. The great mass of feeding roots do not penetrate the soil deeply, but are rather near the surface, as one may readily ascertain by an examination of the soil under a tree.

Because of this shallow-rooting habit, deep tillage destroys a great many roots. It is believed that injury to the roots by too deep tillage, particularly during the growing season, has been a contributing cause in many instances to the failure of figs to do well when attempts have been made to grow them under orchard conditions. The light sandy soils that predominate in the sections where such failures have been most conspicuous are conducive to a deep penetration of the usual kinds of tillage implements.

Fig trees require a good supply of moisture. The results that may follow even a comparatively small reduction of the root system are suggested by a specific instance. In resetting a gatepost that stood near a fig tree a root three-fourths of an inch in diameter was cut off. The tree began to wilt almost immediately, many of the leaves dropped off, and those that remained did not regain a normal condition for several days. Apparently the loss of one main root was sufficient to reduce to a serious extent the ability of the tree to take up moisture.

The location of the moisture supply influences in some degree the development of the roots. In one instance, where a fig tree stood near a building and also within 4 or 5 feet of a board walk 40 or 50 feet long, it was found upon removing the boards that one of the roots had grown toward the walk, and after passing the few feet necessary to reach it had turned almost at right angles and then grown along just under the surface of the ground the entire length of the walk. Where the walk ended the root was nearly half an inch in diameter. Apparently the moisture, temperature, and other conditions of the soil influenced by the shade of the board walk were favorable for root development.

The widespread occurrence of the nema (sometimes called nematode, also eelworm) in the soils in the warmer portions of the country requires special mention. The roots of fig trees are especially susceptible to this parasite, which appears to thrive better and to cause more damage in the light sandy types of soil, such as have been used largely for figs, than in the heavier types. The tendency of tillage is to render soil conditions even more favorable for the destructive work of nemas than they would be otherwise.

The foregoing facts suggest the importance of (1) preventing the growth of weeds and other competing vegetation, (2) very shallow cultivation, (3) using every available means of conserving moisture, and (4) making all soil conditions as favorable as possible for the growth of the trees.

The use of tillage implements which destroy weeds without cutting deeply and which thoroughly stir the surface of the soil is essential.

The commercial fig orchards in the Gulf coast section of Texas usually receive more or less systematic tillage along the lines suggested. As a rule, the growers in Texas are very careful not to work the soil deep enough to injure the roots, especially during the growing season. Sometimes they plow or cultivate rather deeply in early spring, before growth starts, or during the winter, in the belief that a

limited amount of root pruning retards the starting of the buds, thereby avoiding injury from untimely spring frosts. After growth starts only very shallow tillage is permitted, since it is recognized as disastrous to injure the roots during active growth. Shallow cultivation is practiced during the growing season with sufficient frequency to keep down weeds and thereby conserve soil moisture.

The system of tillage followed by the Texas growers has been used in a few instances in Louisiana and east of the Mississippi River with results which justify the conviction that when followed judiciously it gives success so far as tillage can do so. In 1 or 2 cases winter or early spring plowing is followed by very shallow tillage until some time in May, when cowpeas are sown and allowed to grow through the season. No other tillage is given until the orchard is again plowed the next winter.

Trees standing beside buildings usually succeed better in some sections than those which grow in the open. Such trees are shown in figure 2 and on the cover page. In these and similar cases some of the roots are under the buildings and are therefore shaded and protected from the high temperature that is reached in the bare soil when fully exposed to the sun.

If shading the soil is important, then cover crops or green-manure crops may also serve the purpose of giving shade in fig orchards where the soil-moisture conditions admit of their being grown without undue competition for moisture.

Mulching the trees with straw, pine needles, or other material to conserve moisture and shade the ground has been suggested. One grower in Florida who has a small block of fig trees on very sandy soil devoid of all other vegetation observed a very prompt improvement in his trees when they were mulched during their second season's growth, but it seems probable that this practice will afford only temporary advantage, as the roots would doubtless come to the surface of the soil and soon penetrate the lower layers of the mulch, where it remained moist.

Very close planting of the trees with a view to their furnishing shade for one another has also been suggested, but the competition among the trees for soil moisture, as in the use of cover crops, would be likely to defeat the main object of this plan except where moisture is abundantly supplied through irrigation or otherwise.

The real problem in the tillage of a fig orchard is to determine what is needed in each case to make the soil conditions favorable to the growth of the trees and the development of fruit, and then to adopt the methods of soil management that will most effectively accomplish this.

COVER CROPS

In some sections of the fig belt the soils evidently lack fertility and moisture-holding capacity. Such soils, especially where the more sandy types predominate, contain as a rule very little humus. It is important to increase materially the quantity of humus in these soils, and in some cases commercial plant foods are probably needed.

The usual way of increasing the humus in the soil is to grow green-manure or cover crops and plow them under. Cowpeas are largely used for this purpose in the South. Many fig growers, because of the susceptibility of cowpeas to nematodes, are reluctant to use this crop in improving the soils in their fig orchards, but the Iron, Brab-

ham, and Victor varieties of the cowpea are immune or very highly resistant to the nema and may be used without danger. Beggarweed and velvetbeans also may be used, as they are not attacked by nematodes.

The use of green-manure crops as a means of adding humus to the soil has its limitations. It is possible that a green-manure crop that must be grown during a period when the fig trees require large quantities of moisture may do more harm, in some seasons at least, by its competition for soil moisture than it does good by adding humus to the soil.

FERTILIZERS AND LIME

There is no direct means of determining what plant food should be applied to land for the production of any crop except by experiment; that is, by applying different plant-food elements separately and in different combinations and noting the results. If, for instance, the results indicate that where these elements are used separately there is no apparent response to phosphoric acid and potash but a decided response to nitrogen, and that where a complete fertilizer is used there is a response corresponding to that secured with nitrogen alone, they prove in the most effective way possible that phosphoric acid and potash are not needed and that the nitrogen contained therein is responsible for the results obtained with the complete fertilizer. In such a case it is clear that the application of potash and phosphoric acid would be equivalent to throwing away money.

But very little experimental work has been done on the response of fig trees to different forms of commercial plant foods. However, at the branch experiment stations at Angleton and Beaumont, Tex., it was found that nitrate of soda and superphosphate, used separately and in combination, also in combination with muriate of potash, and superphosphate combined with muriate of potash, all increased the yield of fruit sufficiently compared with no fertilizer treatment to be apparently of some significance. Muriate of potash was not used separately. However, when used in combination with superphosphate, also with that and nitrate of soda, there was no increase in yield sufficiently consistent to indicate a response to potash. As a matter of fact, the increases from applications of nitrate of soda and superphosphate are difficult to coordinate, since the yield from these two plant foods in combination were not consistently greater than when they were applied separately. In some instances where a complete fertilizer was used, the yield was less than where nitrate of soda and superphosphate were applied either separately or in combination. There were also instances in 1927 at one of the branch stations in which the yields from most of the fertilizer treatments fell below the check trees which received no fertilizer.

In many cases figs have been planted in soils too poor for the successful production of any crop. Many of the soils that have been used for figs are lacking in humus, and where there is a deficiency of humus nitrogen is also likely to be deficient.

While most fig growers in the southeastern part of the United States use no fertilizers on their figs, some use bone meal at the rate of 1 or 2 pounds per tree, some use raw phosphate, some various brands of complete fertilizer, some stable manure, etc. The usual time of applying commercial forms of plant food is in the spring, at about the time the trees resume their growth.

Hydrated lime has been applied separately and with a complete fertilizer. In some cases increased yields from its use were suggestive of some influence; in most instances no significance could be attached to the results. On other types of soil definitely deficient in lime, its use might have resulted in significant yields.

It is not possible to recommend any particular line of treatment for figs so far as the use of fertilizers is concerned. It is doubtless wise, at least until other evidence is available, to accept the prevailing opinion that an abundant supply of lime is necessary. It is also highly important to keep the soil well supplied with humus, because of the relation of humus to soil fertility. If experience has shown in the growing of staple crops that any particular soil is deficient in some special plant food, it is probable that the same food would be needed for figs. The means that have been found efficient and economical, locally or otherwise, in maintaining the fertility of the soil in growing other crops may safely be followed in enriching the soil for figs.

PRUNING

CARE NEEDED IN PRUNING

Though many owners of fig trees are opposed to pruning, their contention being that the wounds do not heal and that premature decay results, the best evidence is in favor of the practice. It is true that decay very frequently has followed pruning, but it has been chiefly due to the manner in which the wounds have been made, though perhaps fig wood, when cut surfaces are exposed to the air, is less resistant to organisms causing decay than that of other fruit trees. If branches are cut off without leaving a stub or if, in the removal of small or secondary limbs, they are cut back to a point where a side branch or bud occurs, there is usually no serious difficulty in the healing of the wounds.

Pruning should be done annually, during the dormant period of the trees, preferably after the coldest weather of winter is past but before growth starts in the spring.

REASONS FOR PRUNING

Fig trees and bushes are pruned to keep the tops open to the sunlight and air, to keep them within bounds, to remove dead wood and interfering branches, to make the harvesting of the fruit easy as compared with that on trees with excessively dense tops, and to bring about economy in cultivation and the betterment of the fruit.

The bulk of the crop in the South Atlantic and Gulf States, and in the case of most varieties the whole crop produced, is borne on wood of the current season's growth, as shown in figure 9. A single fruit develops in the axil of each leaf, and as the branch elongates and new leaves put forth, other fruits develop. Therefore, in addition to the reasons just mentioned, the pruning of fig trees has as one of its most important objects the stimulating of new wood growth, in order that adequate bearing surface for a large quantity of fruit may be produced. Varieties differ widely, however, in the amount of pruning necessary for their growth and fruit production.

Fig trees growing in yards and about buildings are rarely pruned, but are allowed to grow at will.

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The pruning of fig trees at the time of planting has been described (p. 10), and the differences between a fig tree and a fig bush have been pointed out. Corresponding differences naturally follow in the pruning which the trees should receive in subsequent years. These differences, however, have to do with details rather than with fundamental principles.

There are relatively few fig trees in the entire fig belt east of the Mississippi River. Most young trees have a strong tendency to send up sprouts from the roots, and these sprouts in many instances have been allowed to grow, thus, in effect, changing trees into bushes. Others have been pruned from the beginning with a view to growing the bush form. Again, many fig trees have been killed back heavily at one time or another by low temperatures. Such trees habitually have sent up from the roots a considerable number of sprouts, several of which have usually been allowed to grow, thus developing the bush form.

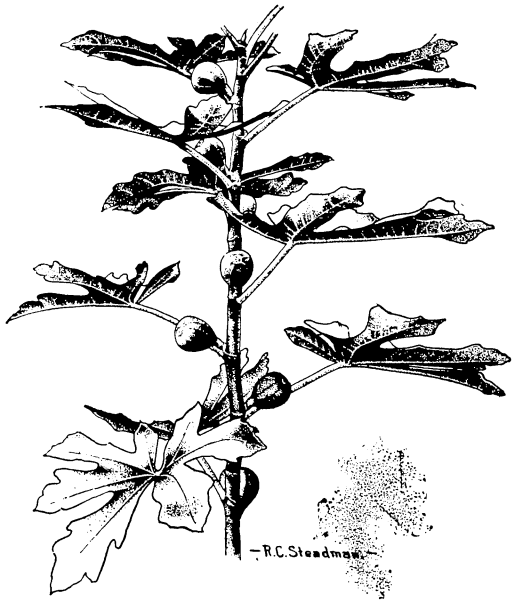

FIGURE 9.—Fig trees bear their summer crop on the new growth. This is the only fig crop that is of much importance in the South Atlantic and Gulf States. The drawing, made from a photograph, shows the development of a fruit in the axil of each leaf. As the branch grows and a new leaf puts forth, another fruit develops in its axil.

The difference in the pruning of varieties from the standpoint of their growth and fruit-bearing characteristics is strikingly illustrated by the treatment of the two most prominent varieties grown in these regions—the Celeste, east of the Mississippi River, and the Magnolia in Texas. Both varieties are of some importance in Louisiana. Hardly any two growers follow the same system, however, or entertain the same ideals with reference to pruning.

PRUNING CELESTE FIG TREES

In the systematic pruning of trees of the Celeste variety the annual growth is headed back somewhat, as indicated in figure 10. This shows a fig pruned to a low tree form as it appeared after its third season's growth. At the end of the first season's growth the limbs were headed back slightly at the points where the lower branches have developed, and the inside branches were cut off to make the top open. The same plan was followed after the second year's growth. The growth during the third season consisted mostly of the short side branches that appear on the upper portion of the limbs, though the main branches have lengthened somewhat.

Thus, the annual pruning has consisted of a slight heading in when the trees were young and such thinning out of the branches as was necessary to keep the tops fairly open. This is adequate, as a rule,

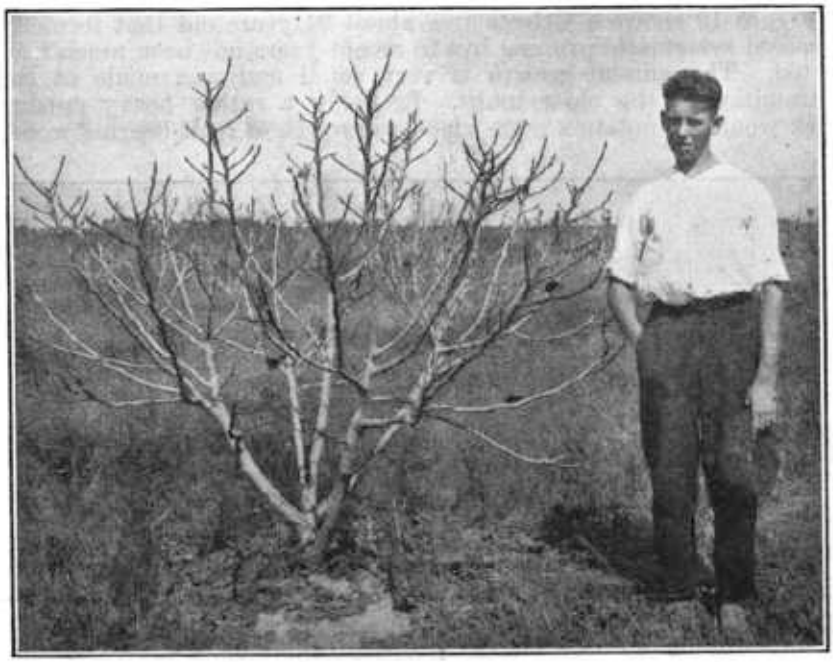

FIGURE 10.—A Celeste fig tree, in a southern Alabama orchard, after completing its third season's growth. It was pruned systematically each year to a low tree form. The interior growth has been pruned out more or less, making an open top. The soil was well cultivated during the earlier part of the season.

and in general the same practice may be followed as the trees become older. The same principles apply whether the tree or bush form is

FIGURE 11.—Important differences in the pruning of different fig varieties are shown in this orchard at Pasadena, Tex. The trees of the Celeste variety (right) have been cut back only slightly or not at all in the annual pruning, while the Magnolia trees (left) have been heavily cut back. The leaves which had started to grow on the Celeste trees were killed by a freeze early in April, about 2 weeks before the picture was taken.

grown. In the case of the latter, from 4 to 5 to perhaps 8 or 10 sprouts or stems are allowed to develop. At the right in figure 11,

trees of the Celeste fig are shown that were headed fairly high when planted, and which have not had much, if any, heading back since. The main limbs have not branched as much as usual, hence the tops are very open.

Figure 12 shows a Celeste tree about 21 years old that formerly received systematic pruning but in recent years has been much neglected. The annual growth is very small and was made at the extremities of the older limbs. Probably a rather heavy cutting back would stimulate a more vigorous growth of fruit-bearing wood.

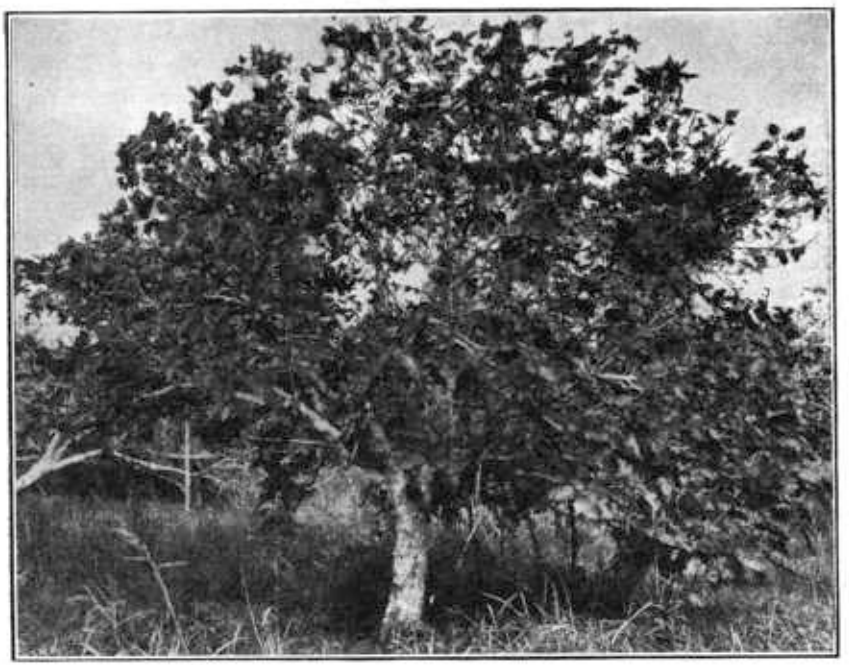

FIGURE 12.—A Celeste fig tree near New Orleans, about 21 years old. It has a small bearing surface for so large a tree. The reason is that pruning has been much neglected in recent years and the new annual growth made near the extremities of the limbs is very short.

PRUNING MAGNOLIA FIG TREES

The Magnolia trees, of which the orchards in the Gulf-coast section of Texas are largely composed, are very much more systematically pruned than the trees of the Celeste and other varieties grown elsewhere in the southeastern part of the United States. The Celeste represents a type of fig tree that usually should be cut back only slightly. The Magnolia, on the other hand, represents a type which apparently will stand what is practically a renewal system of pruning. Figure 13 shows 3-year-old Magnolia trees that have been cut back at the annual pruning during the dormant season in accordance with the so-called "common" method, whereby all but about 5 to 7 inches of the previous season's growth of the branches or shoots is cut away.

In investigations on pruning Magnolia fig trees carried on by the Angleton and Beaumont substations of the Texas Agricultural Experiment Station it has been shown that heavy cutting back of the annual

growth reduces the total crop, as compared with pruning that consists only of thinning out the branches or very lightly cutting them back, but it considerably extends the period over which fruit matures. Under some conditions such an extension of the harvest period would be advantageous, as, for instance, in canning the fruit. If too much fruit ripens within a short period congestion in the canneries could hardly be avoided, whereas a prolonging of the harvest period would make possible an orderly handling of the crop.

PRUNING TO FORM BUSHES

Figure 14 illustrates the results of systematic, progressive pruning of a fig bush over a series of years. This figure shows a Magnolia tree, or one hardly distinguishable from that variety, that was planted and cared for continuously by the same owner and shows the working out of a definite plan of pruning. When planted, the trees were headed low, thus inducing the development of sprouts from below or very near the surface of the ground, the bush rather than the tree form of growth being preferred by the grower.

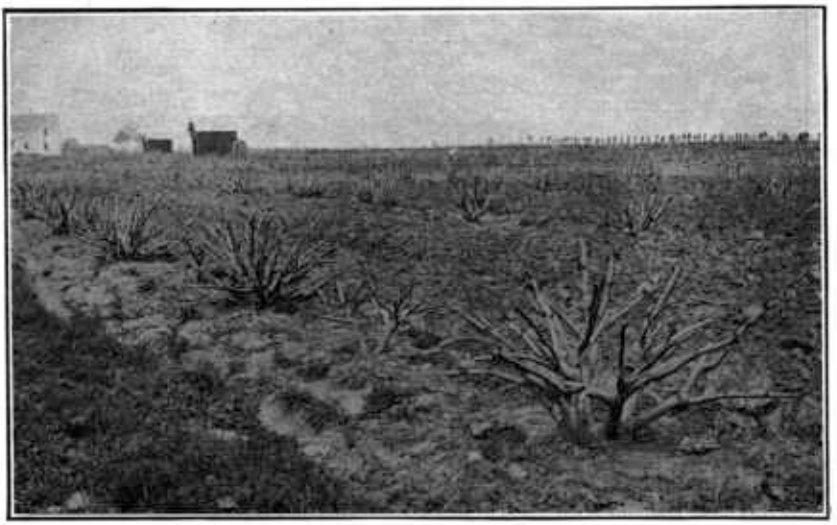

FIGURE 13.—Three-year-old Magnolia fig trees in the Gulf-coast section of Texas in the spring, before growth starts. The previous season's growth has been cut back heavily each year in the annual dormant pruning.

The low branching incident to low heading at time of planting is to be noted. The first season's growth was cut back to within 1 foot of the ground. During the dormant period the second season's growth was cut back heavily, which resulted in more branching and the development of a larger number of limbs in the third season than in the one preceding.

This general plan of heavy heading-back is followed by this grower for the first 3 years only; subsequently, he cuts back the annual growth about one-third or one-half of its length. When it is desirable to make the tops more open it is done by removing entire limbs rather than by cutting back. The interior of the base of a bush pruned by this method is shown in figure 15.

It is also considered a good plan by this grower to pinch back the terminal bud of the annual growth about the 1st of August, or as soon as possible after a desirable quantity of fruit has set without inducing the growth of new side branches. This pinching back checks the elongation of the annual growth, thus preventing the setting of more fruit. It is claimed that this makes the fruit already formed develop to a larger size and ripen more uniformly than it otherwise would.

The long dead stubs shown in figure 15 are seriously objectionable, because eventually decay is likely to set in at these points. The branches should have been cut off even with the surface of the limb on which they occur, leaving no stub. If the wounds incident to pruning are properly made, as above indicated, very little difficulty in their healing is likely to occur; on the other hand, where stubs are

FIGURE 14.—A fig bush of the Magnolia variety, or one hardly distinguishable from it, in its fifth season, considered by its owner to be very nearly his ideal for a bush of this age. The first 2 or 3 years it was formed much as were the bushes in figure 15, but subsequently the current season's growth has been cut back only about one-third to one-half of its length.

left, the wounds cannot heal, and decay may be expected to follow. The fact that stubs are so often left in pruning and that decay results is doubtless the cause of the conviction in some sections that wounds made in pruning figs do not heal.

DISEASES[2]

Most of the fig trees in dooryard plantings are remarkably free from serious diseases. Usually little or no attention is given to controlling such minor troubles as appear, and the trees yield a sufficient supply of fruit for home use year after year. At times, however, the loss becomes great enough to warrant definite control measures. Some

[2] Contributed by H. R. Fulton, principal pathologist, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry.

of the more important fig diseases are briefly discussed in the following paragraphs.

DISEASES OF LEAVES

The most wide-spread and destructive leaf disease is fig rust, caused by *Psysopella fici* (Cast.) Arth. Numerous rusty-brown spots develop, with pustules on the lower side containing yellowish, powdery spores. Badly affected leaves dry and drop. Partial to complete

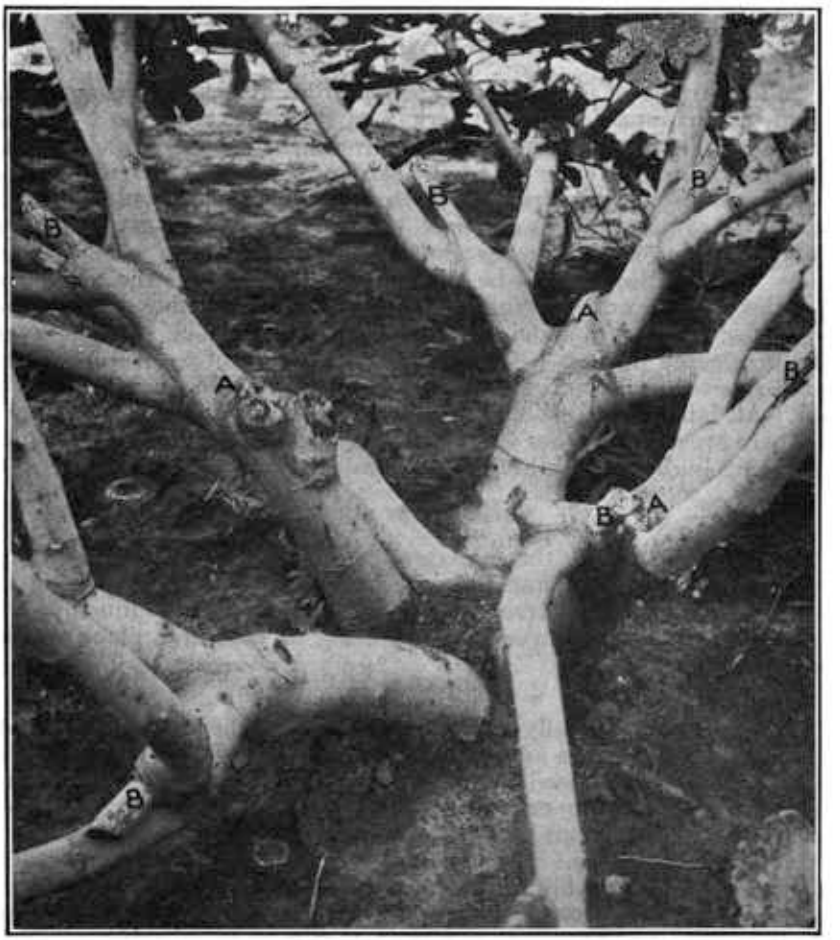

FIGURE 15.—Interior of the basal portion of a fig bush in its fourth season, illustrating some of the details of pruning. The first season's growth was cut back to *A*; the second to *B*. The dead stubs that are to be seen are objectionable. They will not heal over and will eventually decay. In all pruning great care should be exercised to cut off the branches so that no stubs will remain. (View in the same orchard as that shown in figure 14.)

defoliation from rust attack may occur at any time after the leaves are full grown, and is usually worse under warm, humid conditions. When the attack is severe, the fruit is stunted in development and of poor quality or it may drop prematurely. Timely and thorough spraying with 5–5–50 [3] bordeaux mixture will control fig rust. The first appli-

[3] This formula refers to 5 pounds of copper sulphate (bluestone), 5 pounds of fresh lime, and 50 gallons of water.

cation should be made when close watching shows the first evidence of rust spots. Later applications should be made frequently enough to keep the developing foliage protected. This will usually mean every 3 or 4 weeks over a period of 3 or 4 months. Fallen leaves should be raked up during the winter and burned. In subtropical regions an application of bordeaux mixture in midwinter, after the removal of any unshed leaves, is advised.

Two or three other fungi may cause less serious types of leaf spots. They can be controlled by similar spraying with bordeaux mixture.

DISEASES OF LIMBS AND TWIGS

Sudden dying of fig limbs may result from attack by either of two fungi, *Corticium salmonicolor* Berk. and Br., or *C. koleroga* Cke. and Hoehm. The former fungus forms a prominent coating over the bark, varying from flesh color to bright salmon color; the second forms a rather inconspicuous surface growth of grayish or brownish threads or wefts. Both parasites attack the bark and may cause sudden dying of twigs and branches and wilting of leaves on affected portions. These diseases can be controlled by going over the trees 3 or 4 times a year and carefully cutting out and burning all affected branches. The cuts should be made far enough back to remove all of the affected portion. A thorough application of 5–5–50 bordeaux mixture over limbs and trunks will be helpful following the cutting out. All fallen leaves should be raked up and burned.

There are several other fungi that may cause more restricted cankers on fig limbs. They are also controlled by thorough cutting out.

DISEASES OF ROOTS

In certain localities the larger roots of figs are attacked by fungi that cause their death and decay, and ultimately kill the trees. In such cases the affected trees should be removed with as much of the root as possible and burned. Replanting in the same place should be avoided.

FRUIT ROTS

Fig fruits are especially subject to rot during their ripening period. Three important types are watery rot caused by *Rhizopus nigricans*, Ehr., anthracnose caused by *Glomerella cingulata* (Ston.) Spauld. and Schrenk, and souring caused by several organisms. Wet weather favors the development of such troubles. Varieties differ considerably in susceptibility. When fruit rot prevails, gather the figs as soon as they are usable, in extreme cases holding them spread out in the house for a day or two to finish ripening. Decaying fruit on the trees and the ground should be promptly removed. If mummied fruits hang over winter, they should be removed. It does not seem to be practicable to protect the fruit by special spray applications.

FRUIT SPLITTING

Fruit splitting develops in some varieties more than in others, and results from an inability of the fruit to withstand increased turgor. It usually occurs in ripening figs under conditions of high humidity and low temperature. It is most pronounced during periods of showery weather, and opens the way for souring organisms to attack the

fruit. There is little to be done about it, except to pick and use the fruit as promptly as possible.

FRUIT DROPPING

The dropping of immature fig fruits may be due to several causes. In the case of chance seedling fig trees of the Smyrna type, dropping is due to lack of pollen transfer from the wild caprifig through the agency of the *Blastophaga* wasp. This is discussed more fully under Varieties. In regions where the caprifig and the wasp are not established, Smyrna figs will not mature fruit, and should be regarded merely as ornamental plants. Barren trees of the Smyrna type can be top-worked by grafting to self-fruitful varieties, but it is not always practicable to do so.

Sometimes dropping of figs is due to a diseased condition of some part of the tree, such as a severe attack of root knot or leaf rust. In such cases characteristic symptoms of the disease will be in evidence, and appropriate control will result in fruit production.

In still other cases the fundamental cause of fruit dropping may be unfavorable environmental conditions, such as winter injury, drought conditions, poor drainage, impoverished soil, fertilizers that overstimulate vegetative growth, shading, or cutting of roots in cultivation. Young, rapidly growing fig trees may fail for several seasons to carry a full crop to maturity and later slow down in growth and bear normal crops.

PESTS

INSECTS[4]

The well-ordered fig orchards of the South Atlantic and Gulf States are not particularly susceptible to the attacks of insects of serious economic importance. This is especially true with fig trees continuously receiving proper cultural attention. The most serious depredations caused by fig insects occur on isolated trees grown for ornamental purposes and trees in dooryards in the cities.

The insects which most often attract attention on fig trees are the three-lined fig-tree borer, the fig mealybug, and the camphor scale. The work of 3 or 4 species of wood-boring beetles—chiefly that of the fig-tree borer—undoubtedly occasions more apprehension than the combined injury of all the other insects mentioned.

THREE-LINED FIG-TREE BORER

The three-lined fig-tree borer (*Ptychodes vittatus* Fab.) has been definitely identified as damaging fig trees in Louisiana and Texas only, though it is possible that it occurs in Alabama and Florida as well. The mature beetle is a gray-brown insect with three scalloped white stripes, one on each side and one in the center of the back extending almost the full length of the insect. The female averages nearly 1 inch long by ¼ of an inch wide; the male is smaller, sometimes only ⅝ of an inch long by 3/16 of an inch wide. The antennae are more than twice as long as the body. The larva, or borer proper, is a white legless "sawyer", ranging in length from about ⅛ of an inch at hatching to 2 inches or more when its growth is completed.

[4] By A. W. Cressman, associate entomologist, Division of Fruit and Shade Tree Insects, Bureau of Entomology and Plant Quarantine.

The beetles usually make their first appearance in March and soon thereafter begin to deposit eggs, continuing to do so throughout the summer. Egg laying is greatly retarded from October to January and generally ceases completely during January and February. The eggs are deposited in the bark of the trunk and larger branches, almost always near a diseased or injured area, or in a cut or broken stump, and hatch in from 3 to 8 days. The females live from 3 to 8 or 9 months and deposit from 130 to 260 eggs each. The young sawyers feed in the bark or near the surface for from 1 to 3 weeks, then usually work deeply into the wood, often going to the very heart of the branch or trunk. The larvae continue to mine in the wood for 2 or 3 months or longer, after which they enter the resting or pupal stage and finally emerge as fully developed beetles. The borers prefer to lay their eggs in trees that have been injured in some way; but, once they have become established in a locality, they may attack perfectly healthy, sound trees that are adjacent to an infested tree. The borers thrive in either living or dead wood, but they prefer wood that is dying and has lost a portion of its sap.

Preventive measures against this borer are better than remedial measures. The young fig tree should be properly pruned to give it the best shape to withstand heavy winds. It is very important to avoid bruising the bark in cultivation, or with the ladder or the feet in picking the fruit. Whenever a branch is accidentally broken, it should be cut off smoothly immediately at its juncture with the larger branch or trunk, and the wound painted with a mixture of 5 parts of coal tar and 1 part of either creosote or crude carbolic acid. As soon as this is thoroughly dry, at least a second and possibly a third coat should be applied.

Any trees in the orchard that have become thoroughly infested with the borers should be cut down and every scrap burned, as otherwise the insects will survive in the deadwood, emerge, and injure other trees. Trees consisting of 3 to 6 volunteer sprouts from the root of a previously destroyed tree and remains of broken-down trees, such as are often found in yards in the towns, may as well be destroyed at once, as they are usually of little value and are almost sure to be a source of infestation.

Borers in individual trees which are highly prized but already infested may be dug out, if the infestation has not progressed too far and its area is limited. The eggs may also be destroyed with a sharp knife or an awl. This treatment should be given by one familiar with the appearance of the eggs and egg punctures and also with the methods of dressing and treating the cuts made in removing the larvae. The laying of eggs may be prevented to a considerable extent by ensheathing the trunk and larger branches in wire netting. The screen must be kept in place practically throughout the year, however.

FIG MEALYBUG

Mealybugs often become numerous on the branches, leaves, and fruit of fig trees in the South. In Louisiana, a small number of mealybugs pass the winter in protected places in the bark of fig trees. They sometimes multiply rapidly in the spring, become plentiful in April or May, and continue to increase in numbers until the latter part of July or early August, when their natural enemies gain the upper hand. The peak of the infestation, if uncontrolled, frequently coincides with

the time of maturity of the fruit and may cause complete defoliation and loss of crop. The mealybugs are usually attended by the Argentine ant, but it is doubtful whether the ants play any important part in fostering the infestation.

Because the mealybugs pass the winter beneath crevices in the bark, in burrows made by the fig-tree borer, and in similar places, it is difficult to reach them with winter sprays. Trees which are infested should be sprayed as soon as possible after the spring growth of leaves has hardened. Care should be taken to spray thoroughly both surfaces of the leaves, as well as the branches and trunk. The pressure should not be less than 50 pounds per square inch, and preferably 100 pounds.

Perhaps the best spray to use is made up with any one of the derris extracts, several of which may be obtained from agricultural-supply houses. This should be diluted to contain one-half ounce of rotenone, the most important active ingredient, in 19 gallons of water. Two ounces of soft soap or 1 ounce of hard soap should be added to each gallon of water used for dilution of these extracts, and the spray should be applied immediately after mixing, since rotenone quickly loses its effectiveness when combined with soaps. Fig trees are very susceptible to injury from insecticides, and application should never be made in the bright sunlight. After 5 p. m. the danger of injury is comparatively slight.

Since it is difficult to kill all the eggs of the mealybug, it may be necessary to make a second application about 2 weeks after the first. By that time the eggs which survived the first spray will have hatched, and the nymphs will be exposed to the second application.

CAMPHOR SCALE

The camphor scale (*Pseudaonidia duplex* (Ckll.)) was first discovered in Louisiana in 1920, and at the present time (1934) it is confined largely to southern Louisiana. The females are found on the branches, leaves, and fruit of fig trees. When the insect is full-grown, the scale-like covering of the female is one-sixth to one-eighth of an inch in diameter and gray to chocolate-brown in color. The insect beneath this covering is white to purplish brown, depending upon its age.

Since large numbers of the females go to the leaves, and these are shed each fall, there is a natural thinning of the population each year. However, when trees have been unsprayed for several years the infestation on the branches may increase to the point where it weakens the tree and disfigures the fruit.

The camphor scale may be controlled by spraying with oil emulsions. These should be applied when the tree is thoroughly dormant, using 2½ to 3 percent of oil. Heavy infestations of the camphor scale are more difficult to control than are light infestations, and if many scales are present it may be necessary to make two applications about 1 month apart. These sprays should not be applied when the trees are in foliage, as severe injury will result.

SOFT SCALE

The soft scale (*Coccus hesperidum* L.) also occurs to some extent on fig trees in the Gulf States. This insect settles in groups on certain branches and along the lower surface of the leaves near the midrib. At times these groups become quite populous and cause a certain

amount of smutting of leaves and fruit. This insect, however, has so far been kept under practical control by natural agencies.

OTHER INSECTS

Some noticeable and widely distributed insects are injurious to the fig, although not specifically fig pests. For instance, June bugs, bees, and wasps are frequently seen eating the fruit; but rarely, if ever, are they the original cause of injury. Where the fruit cracks or the skin is broken in any other way, the insects mentioned commonly take advantage of the injury and eat the fruit to a considerable extent. The actual damage, however, is comparatively slight, as the fruit that cracks or is injured mechanically is likely to ferment and spoil in a comparatively short time if it is not promptly picked. No special remedial measures can be suggested.

BIRDS

Birds of various kinds often eat considerable fruit, but they rarely eat fruit that has not previously cracked or been injured in some way so as to expose the flesh. Cracking is especially likely to occur when the fruit ripens in damp or rainy weather.

NEMAS

Probably the nema (nematode) *Heterodera marioni* (Cornu) Goodey is of greater economic importance in fig growing than any other parasite. The nema is a very minute eellike or wormlike organism which is so small it can hardly be seen without a microscope, except by a carefully trained eye. Nemas live in the small roots of the plants, causing characteristic knotlike swellings, which occur on many kinds of plants growing in mild climates. In colder regions, where the ground freezes deep for long periods at a time, comparatively little damage is caused by the nema. In the South they cause great losses in crop production.

It is impossible to state the extent to which nemas may limit the growing of figs. However, it is known that the roots of fig trees are very susceptible to them, and that the root swellings which indicate their presence occur in great numbers in many places in the region covered by this bulletin. It is at least reasonably certain that they have added materially in many instances to the effect of other difficulties encountered in fig orchards that have failed. Nemas are known to work more readily in very light, loose, sandy soils than in the heavier types, and the fig orchards that have failed usually have been planted on such soils. Little can be suggested in regard to controlling nemas in fig plantings after infestation has occurred, except to make the conditions for tree growth as favorable as possible. Under such conditions a tree may grow and bear fairly well in spite of a considerable infestation of nemas. This is because its root system is renewed after portions of it have been injured. Under conditions less favorable for the tree, or more favorable for the nemas, the trees become stunted in growth, and the leaves and fruit may fall prematurely. Usually conditions in dooryards are less favorable for nema development than those in orchards, particularly in sandy soils.

In selecting a site for a new fig orchard the infestation of the soil with nemas should be considered. Freedom from them is exceedingly important. Nemas may be introduced on the roots of the trees when planted. If infestation appears in a restricted area, digging up and burning infested trees and entire root systems is advised. For such areas the soil may be disinfected with a double application of ammonium thiocyanate at the rate of 200 pounds to the acre, applied in solution at intervals of 2 weeks.

VARIETIES

Figs of the Adriatic type are grown in the Southeastern and Gulf States. The fruit develops without pollination; hence the seeds are not viable.

Many seedling fig trees are, however, growing in the South, but in practically all cases they appear to have grown from seeds of imported Smyrna figs (the common imported dried fig of commerce). The Smyrna type of fig does not develop its fruit to maturity as a rule except when it is pollinated, and pollination is effected only by a certain kind of insect, the *Blastophaga*, which lives over winter in what is termed a caprifig. Caprifigs produce pollen, but their fruit is of little or no value for edible purposes. As this insect has not yet been definitely established in the South there is no practicable means whereby the Smyrna seedling figs there can be pollinated. This fact is of considerable importance, as a question frequently asked is why certain fig trees drop their fruit when it is only partly developed. There is occasionally an apparent exception to the rule that Smyrna seedlings require pollination, but it is not of special importance in this connection. The matter of establishing the *Blastophaga* in the South has been investigated somewhat, but the results have not been promising.

As previously stated, the Celeste is the variety very largely grown throughout all but the Texas portion of the fig belt. In the Gulf-coast section of Texas the Magnolia is of similar or perhaps even greater relative importance than the Celeste elsewhere. Trees of the Celeste, as well as of other varieties, occur occasionally in Texas, but in such small numbers as to be unimportant except as dooryard or garden trees.

Other varieties that occur more or less in Louisiana and eastward are the Black Ischia, Brunswick, Ischia (*White Ischia, Green Ischia*), Lemon, Brown Turkey, and occasionally others of small relative importance. Of this list of secondary varieties, the Brunswick and Brown Turkey are of greater importance than the others.

CHARACTERIZATION

[It should be explained that a fig tree may produce 1, 2, or even 3 crops of fruit in a year, depending upon the variety and the conditions under which it is grown. In a general way these crops are seasonal and develop at different periods in the year. Any 1 or any 2 of these crops may be wanting in any variety; in fact, 2 of them, the first and third, are usually wanting under the conditions that prevail in the South Atlantic and Gulf States. A few varieties sometimes produce first and second crops. The Brown Turkey does this more commonly than most varieties, though several others occasionally develop small quantities of fruit in this crop. The crop which corresponds to the second is the main and really important one throughout the areas under consideration, while the third crop is rarely produced there. It is therefore the second crop that is referred to in the characterization of varieties that appear under this heading.]

Black Ischia.—Fruit medium in size; skin bluish black; pulp crimson; quality good. Season begins about the middle of July. Tree regarded as less hardy than Ischia (*Green Ischia*).

Brown Turkey.—The tree is commonly considered nearly as hardy as the Celeste, and at some points along the South Atlantic coast it is grown in preference to that variety. Fruit medium to large, broadly pear-shaped; skin coppery brown; pulp whitish, shading to pink about the seeds; quality good to very good. Season begins about the middle of July and continues for 2 months or longer.

Brunswick.—Fruit large to very large, broadly pear-shaped, ribs well marked; skin bluish purple to dark brown; pulp white or nearly so under the skin, shading to pink toward the center, thick, soft; quality good to very good. Season begins last of July and continues for some weeks. A variety more or less planted under the name "Jennings" is commonly said to be identical with the Brunswick.

Celeste.—(Synonyms: *Celestial, Sugar.*) This variety is better known under the first synonym mentioned than by its approved name. It is by far the most widely and extensively planted variety in the fig belt outside of Texas. It is considered a standard of hardiness and can be grown where less hardy varieties fail. Probably to this fact more than to any other is due its wide distribution. Fruit small to medium, pear-shaped, ribbed; skin violet, sometimes shading to purplish brown; pulp whitish, shading to rose color at the center. Its season throughout the regions where it is important begins about June 20 to early July and extends for a period of 3 or 4 weeks.

Ischia.—(Synonyms: *Green Ischia, White Ischia.*) Fruit medium in size, long; skin pale green; pulp crimson; quality good, with rich, sweet flavor. Season begins about the first of August, continuing until frost.

Lemon.—Fruit medium to large, flattened, slightly ribbed; skin yellowish green with light oval dots, brownish on exposed side; pulp whitish under skin, darker towards the interior; quality only fair, sweet. Season begins the last of June or early July, continuing for several weeks.

Magnolia.—This variety practically makes up the commercial fig industry of the Gulf-coast section of Texas. It does not appear to be well adapted to the region east of the Mississippi River, various reports indicating that the tree makes a rather weak growth and that the fruit cracks badly. It is grown to a limited extent in the western part of Louisiana, where it succeeds fairly well. Fruit large; skin greenish amber or pale green; quality good. Season begins about the middle of July and continues until frost. A few growers in Texas have a variety known as the "Texas Wonder", which is very similar to Magnolia and may be identical with it; it is claimed that it is better in some respects than the Magnolia.

Ramsey.—This variety originated as a seedling at Austin, Tex., about 1908, and was introduced to the trade in the fall of 1915 by F. T. Ramsey & Son, of that city. Its special points of merit are its productiveness and good size. The fruit is said to crack less than the Magnolia. Though not widely tested, it has sufficient merit in the locality where it originated to warrant fig growers in giving it some attention.

HANDLING THE FRUIT

Where figs are grown in a climate more or less arid, as in California, the fruit can be left on the tree without deterioration until it is ripe enough to drop of its own accord. When this stage of ripeness is reached the fruit is partially dried.

The figs grown in the humid sections of the South Atlantic Coastal Plain and the Gulf coast are very perishable. Some varieties are less perishable than others, but all the figs grown in these areas sour and ferment under ordinary conditions within a comparatively short time after they are picked. Prompt utilization of the fruit as it ripens is therefore necessary, especially in damp, muggy, or rainy weather, when figs spoil more quickly than they do in bright, clear weather.

Besides their consumption in the fresh state, many figs are utilized for canning and preserving in the home, and in Texas commercial canneries handle most of the crop. In some sections the surplus fruit from the small home plantings is collected by those equipped to handle it, canned in considerable quantities, and sold to people in the North

or elsewhere. Many girls' canning clubs have engaged in work of this type. A few canneries outside of Texas operate on a commercial scale with figs, but in such instances the bulk of the fruit used is produced on trees growing in dooryards and about buildings.

Figs are not suitable for eating in the fresh state until fully ripe, and when in that condition they soon become soft. For shipping, canning, or preserving in other ways, the fruit should be picked before it begins to soften, but not until it is fully grown and at the point of beginning to soften. The exact stage of maturity at which it should be picked can be learned only by experience.

The fruit is commonly placed in 10- or 12-quart pails, or buckets, as shown in figure 7. The milky juice which exudes from the stem of the figs when they are picked at the stage of maturity preferred for shipping and canning is very irritating to the flesh. Pickers should take pains to prevent as far as possible the juice from coming in contact with the hands; otherwise serious sores, especially on the fingers, may result. The foliage is also more or less irritating to the flesh, and care should be taken by pickers to avoid coming in direct contact with it more than is absolutely necessary. Various methods of protecting the hands and arms are used by pickers. Some pickers wear gloves or rubber finger tips. Others smear beef suet or some other form of grease or oil on the hands, and also on the arms where the latter are exposed. Frequent washing of the hands in vinegar is said also to counteract to some extent the effect of the juice.

SHIPPING FRESH FRUIT

As figs grown in a humid climate spoil soon after they are picked, the fresh fruit grown in the South is marketed largely in the locality where it is grown, or shipped to destinations that can be reached by express within a few hours of the time the fruit is picked.

Shipping under refrigeration would doubtless materially widen the radius of distribution, but, except in Texas, figs are not now grown at any point in these sections in a sufficiently large quantity to permit shipping in car lots; hence, refrigerator-car service is impracticable at present.

When prepared for market, fresh figs are usually placed in quart baskets, like those in common use in shipping strawberries and other small fruits, and these baskets are packed in ordinary 24- or 32-quart crates. Occasionally the 6-basket or Georgia-peach crate is used, but in this style of package the individual containers are too large to be suitable in view of the delicate character of the product, and the figs in the bottom of the baskets are often crushed or badly bruised from the pressure of the fruit above them.

To a limited extent figs have been packed in specially made pony refrigerators, similar in their general features to those used very early in the season in shipping strawberries from Florida to the northern markets. This method is successful for the specialist, but probably not practicable for the average grower. However, the use of these refrigerators has demonstrated the possibility of reaching more distant markets with figs, when the necessary details of handling and transportation are carefully observed.

UTILIZATION

FACTORY CANNING

Practically the entire fig crop of Texas is canned, the fruit being handled in local canneries at the important centers of production. Because of the very perishable character of the fruit, a cannery so located with reference to the place of production that the figs can be delivered to it within a few hours after they are picked is practically an essential to the successful handling of the crop. In the Gulf-coast section of Texas, where the Magnolia variety is largely grown, the canning season begins between the middle of July and early August and continues until frost occurs, if crop conditions are favorable.

For the best results the fig trees should be picked over every day at the height of the season or every other day when the fruit is ripening slowly. In this way figs of a uniform degree of maturity can be secured. If the fruit is too ripe, it will not retain its form when cooked. It is only when every fruit in a can retains its form that a product of the highest grade is secured.

Each canner has his own particular practices as to details, and in most cases these are rather jealously guarded. In general, however, the process consists in dipping the fruit for a few seconds in a boiling-hot solution of lye in order to remove the skin, washing in several changes of water to remove the lye, cooking in a heavy sirup for 2 to 4 hours, and packing in tin cans or glass jars.

It is the figs of the Magnolia variety especially from which the skin must be removed in order to obtain a particularly high-grade canned product. The lye solution should be strong enough to remove the skins quickly; this requirement should regulate the amount of lye used in a given quantity of water rather than any fixed proportions. A pound of lye to 10 or 12 gallons of water is sufficient for most kinds of fruit. The washing of the fruit after the lye bath is accomplished preferably in running water, though dipping the fruit in several water baths which are frequently renewed with fresh water will serve the purpose. Long cooking thoroughly impregnates the fruit with the sirup. When packed in glass jars each fruit is carefully placed with stem uppermost, so that the contents of the jars present a very symmetrical, attractive appearance. Figs so packed are ordinarily very high priced.

Considerable quantities of figs are commercially canned also in some portions of the fig belt outside of Texas. At a few points there are small canneries of some local importance in which figs only are handled, while other canneries, engaged primarily in putting up oysters, shrimps, and other marine products, make a "run" on figs for a few weeks during the height of the season of the Celeste variety, that being the only variety produced in most localities in sufficiently large quantities to be important from a commercial standpoint. Celeste figs are usually canned without removing the skins.

The figs used at these canneries are produced mostly by dooryard and garden trees, which in the aggregate supply considerable quantities of fruit. The fruit from these numerous growers is commonly brought together at convenient centers, and from such centers it is taken to the canneries.

HOME METHODS OF PRESERVING[5]

Except in Texas, the utilization of figs in the sections covered by this bulletin is essentially a problem for the housewife.

Considered with reference to food value, figs are among the first in the list of our fruits. None should be allowed to go to waste. Only the fully ripe figs are suitable for eating fresh, but the unripe as well as the overripe fruit may be preserved to advantage. The fresh ripe fruit is desirable for canning, preserving, etc., the overripe figs for making jams, marmalades, and confections, and the unripe fruit for sweet pickles. Figs add variety to the diet, are acceptable in many forms, and may be made into delicious confections.

Directions for the preservation of figs by the various methods and suggestions made by practical housewives and others are given below.

CANNING FIGS IN THE HOME

Use firm, well-ripened, but not overripe, freshly gathered fruit. The preliminary treatment of the fruit will vary somewhat with the variety used. In the case of the thin-skinned varieties, such as the Celeste, the fruit is scalded in a hot soda solution, prepared by dissolving a cupful of baking soda in 6 quarts of boiling water. The fruit is placed in this boiling-hot solution and allowed to stand 15 minutes, but without additional heating. The solution is then drained off, the figs are washed in several changes of clear cold water, and after draining are ready to be cooked. Thicker skinned varieties, such as the Magnolia, yield a more attractive and satisfactory canned product if the figs are peeled before being canned. Scald the fruit in a hot lye solution[6] until the skin is loosened, wash in several changes of clear cold water, and rub the skin from the fruit with the fingers or a cloth. Stems and patches of skin that have not come off should be removed with a knife. After a final rinsing and draining the figs are ready for cooking. The fruit should be cooked for 40 to 60 minutes in a sirup prepared from 1 part of sugar, or corn sirup, and 2 parts by measure of water. Pack the figs in jars which have just been sterilized by boiling in water and which are still hot. An attractive product is obtained if the figs are carefully arranged in the jars with all stems pointing upward. Cover the fruit in the jars with the hot sirup, adjust freshly scalded rubbers, and put on the covers, but do not seal at this time. Now process—that is, boil—the fruit thus packed in the jars in a hot-water canner if one is available. If not, the processing may be done in an ordinary kettle or a wash boiler with a tight cover and a false bottom of wire netting or strips of wood to prevent the jars from coming in contact with the bottom of the vessel. The water in the vessel should be of such depth that the cans are entirely submerged. Pint jars of the fruit should be processed in this hot-water bath for 30 minutes; quart jars for 40 minutes. The time should be counted from the time the water begins to boil. At the completion of the processing, screw down or clamp the covers tightly, thus sealing the jars. Remove from the water, protect from cold drafts in order to prevent the jars from breaking, and, when cool, label and store.

FIG PRESERVES

Select and prepare the fruit as for canning. Prepare a sirup by boiling together for 10 or 12 minutes 2 parts of sugar, or corn sirup, and 3 parts by measure of water. Skim, if necessary. Add the well-drained fruit gradually, so as not to cool the sirup. Cook rapidly until the figs are clear and tender. When the fruit is transparent lift it out carefully and place in shallow pans. Pour the sirup over the figs, taking care that the fruit is entirely covered. Let stand overnight. Next morning pack the figs in freshly boiled jars; fill the jars with the sirup, cap, and process, as in canning them. Seal immediately, cool, and store.

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[5] Compiled by C. A. Magoon, senior bacteriologist, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry.

[6] The lye solution is prepared by dissolving the dry household lye in water in the proportion of 1 ounce of lye to 1 gallon of water. Care must be taken that the lye solution does not come in contact with the hands or clothing, as it will cause serious injury.

FIG CONSERVE

1 pound figs.
¾ pound sugar and 1½ pints water. (Or 1½ cups corn sirup and 2 cups water.)
¾ cup nuts.
½ orange (pulp and peel).
½ cup raisins.

Cook the figs as for preserves. Cut into small pieces, add the orange and raisins, which have likewise been cut into small pieces, and cook together for 1 hour. Add the nuts 5 minutes before the cooking is finished. Pack and seal hot. Process pint jars for 30 minutes.

FIG MARMALADE

Use the overripe fruit, which must be treated in the hot soda bath, as described under canning figs in the home. Use three-fourths of a pound of sugar to 1 pound of fruit and cook together. Mash fine with a potato masher or strain through a colander. Cook until thick. Pack and process as for preserves.

FIG LEATHER

Take very ripe figs. Wash and mash to a very fine pulp. Spread on platters and dry in the sun or in the oven. When the leather is dry, dust with powdered sugar and roll up like a jelly cake. Cut into pieces of suitable size and pack away in jars. This leather may be eaten as a confection or soaked in water and used for pies, etc. The powdered sugar may be left out if not desired.

A leather prepared by using equal proportions by measure of figs and peaches makes a very fine product.

CANDIED FIGS

Take 4 pounds of figs (any variety) and use with them 4 cups of sugar and 2 cups of water, or 5 cups of corn sirup and half a cup of water.

Prepare the figs as for canning. Make a thick sirup of the sugar and water (when sugar is used instead of corn sirup), add figs, and cook until they are clear. Dip out and drain. Spread on plates in the sun or place in a drier to dry. Protect from insects. Turn the figs every day and press flat. When well dried, dust with powdered sugar and pack in boxes or jars. If preferred, they may be layered in granulated sugar.

CRYSTALLIZED FIGS

Prepare the figs as for candying. Make a thick sirup and while it is boiling drop the figs into it. Remove, drain, and dry. Repeat several times until the figs are thoroughly coated with crystallized sugar.

SWEET PICKLED FIGS

Take 5 quarts of half-ripe figs, with stems. Put into salt water and let them stand 12 hours. Drain them, and then parboil in alum water, using a piece of alum half the size of a nutmeg dissolved in water sufficient to cover the fruit. Be careful that the skins do not break. When soft, take them out and wash them in several changes of clear water to remove the alum, and drain well. Make a sirup by using a pint of vinegar and a pound of sugar. Flavor with mace, cinnamon, and cloves, and when the sirup has boiled, put in the figs. Can in glass. Process pint jars for 20 minutes.

DRYING[7]

DRYING IN THE SUN—A CALIFORNIA PRACTICE

In the fig-growing districts of California the drying of the fruit by exposure to the sun is much practiced. The Mission (*California Black*), Adriatic, and certain other varieties of the Adriatic type of figs and several sorts of the Smyrna type are used principally for this purpose. The growing of Smyrna figs in California for drying

[7] By J. S. Caldwell, senior physiologist, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry.

has developed into an important commercial industry in comparatively recent years.

In California, figs for drying are allowed to remain on the trees until fully ripe or slightly shriveled, or, more commonly, until they drop to the ground. Some growers grade the fruits roughly for size; then after being subjected for a considerable time to the fumes of burning sulphur they are spread in a single layer on trays and exposed to the sun. Sometimes the fruit is immersed for 5 to 10 minutes in a brine solution made by dissolving 1 pound of salt in 4 gallons of water before being spread on the trays. In this method sulphuring is omitted, but sulphuring is habitually followed by commercial growers.

During the drying, which requires 6 to 10 days, the figs must be turned over several times. As the fruits do not dry uniformly, those which progress most rapidly must be removed from the trays from time to time as they become sufficiently dry. Figs have reached the proper degree of dryness for removal when they have acquired an elastic, leathery texture and when no moisture can be squeezed from a freshly cut surface by strong pressure between the fingers.

The dry fruit is piled to a depth of 1 or 2 feet in a well-ventilated curing room or in a large open box and thoroughly stirred at intervals of a day or so for 2 weeks. During this time the drying continues slowly and the remaining moisture becomes uniformly distributed throughout the entire mass.

Following this, the fruit is usually dipped for 2 to 5 minutes in a thin sirup made by dissolving 1 pound of sugar in a gallon of water, after which it is drained for an hour or so and then packed in permanent containers.

SUN DRYING NOT SUCCESSFUL IN SOUTHERN STATES

The sun-drying method practiced in California cannot be successfully employed for the drying of figs in the Southern States, as its success depends upon the prevalence of uninterrupted sunshine, rather high temperatures, and low atmospheric humidity throughout the period in which the crop is harvested and dried. The occurrence of these conditions cannot be depended upon in the southern fig-growing territory. Fermentation and spoilage of the fruit invariably occur during the long period required for drying.

DRYING WITH ARTIFICIAL HEAT

For the reason just given, some type of drier employing artificial heat is a necessity if the drying of figs is to be undertaken. If such equipment is available, the following method will give good results with any of the common varieties such as Celeste, Magnolia, Brunswick, Brown Turkey, and Black Ischia:

Allow the fruit to become well-ripened on the tree and pick over carefully after gathering, culling out all overripe, soft, or fermenting fruits. Dip the fully ripened, still firm fruit in a vigorously boiling lye solution made by dissolving concentrated lye (caustic soda) in water at the rate of 1 pound to 10 gallons of water. The purpose of this treatment is to facilitate drying by partially removing the waxy waterproof coating of the fruit, and is attained when fine parallel cracks or checks appear in the skin of the fruit. This result is usually secured by dipping for 1 minute, but the exact time will vary with the degree of ripeness and also with the variety. After the lye dip, the fruit must be thoroughly washed

in several changes of water to remove adhering lye, spread in a single layer on trays, and immediately placed in the drier. The temperature should not be allowed to exceed 115° to 120° F. for the first 4 or 5 hours of drying or until the fruit has lost enough moisture to become noticeably shriveled, as overheating may cause bursting of the fruit and loss of sugar by dripping. The temperature may be increased to 140° to 150° after the fruit has lost one-third to one-half its original moisture. The fruit should be stirred at intervals to prevent its sticking to the trays. As it does not dry uniformly, it will be necessary to look the trays over as the drying process approaches completion in order to remove the drier fruits before overdrying occurs. The drying has proceeded far enough when the fruit is still leathery and elastic, but does not yield moisture when torn across and firmly pressed between the fingers.

The type of fig grown in humid sections makes a wholesome dried product, but it lacks the necessary attractive appearance to render it acceptable in trade channels. Drying should therefore be restricted to the preparation of supplies for home use, unless some special market outlet is known in advance.

STORAGE OF DRIED FRUIT

Prior to being packed in permanent containers, the dried fruit should be piled in a warm, dry room, protected from insects by screening, and allowed to remain for a few days to equalize the moisture content throughout. Occasional stirring will facilitate the process. This treatment, which is really a continuation at a slower rate of the drying process, distributes the moisture present uniformly throughout the mass, thus preventing the growth of organisms and fermentation in any fruits which were somewhat too moist when removed from the drier. The dried fruit must be stored in containers which effectively exclude such insects as the dried-fruit fly and small beetles, and it is well to use a type of container which is also practically moisture-proof. Slip-top and friction-top containers such as are commonly employed for coffees, sirups, cooking oils, and lard are excellent for the purpose. Heavy paraffined paper bags make fairly satisfactory containers provided they can be securely closed at the top to keep out insects and are then placed inside closely woven muslin bags; this additional protection is necessary as some of the insects attacking dried fruits are able to cut through paraffined paper.

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